

example, a parabola can be found differing but little from $\sin x$. To show that the stresses $\hat{x}\hat{x}$ and $\hat{z}\hat{z}$ are widely different in a plate dam and in a complete dam, it would therefore seem essential to integrate the two equations given by Prof. Pearson in his last letter, and to compare these integrals, or else to decide the matter on other considerations. The integration is, I understand, impracticable, and this being so, the argument in my letter of January 2 would seem to apply. It was to the effect that if in the case of a plate it is permissible to write $\hat{x}\hat{y} = \hat{y}\hat{z} = \hat{y}\hat{y}$ throughout, then to the same order of approximation the stresses $\hat{z}\hat{z}$ and $\hat{x}\hat{x}$ are the same in the plate dam and in the actual structure. If the stresses $\hat{x}\hat{y}$ and $\hat{y}\hat{z}$ are zero in the case of the plate, then the stresses $\hat{y}\hat{y}$ which are developed when the lamina forms part of the complete structure cannot, themselves, give rise to any such shears as $\hat{x}\hat{y}$, $\hat{y}\hat{z}$, or $\hat{z}\hat{x}$, and as the dam is not constrained at top or flanks, it is difficult to see how, in the absence of these shears, the stresses $\hat{x}\hat{x}$ and $\hat{z}\hat{z}$ can be affected. Certainly not by the 30 per cent. which Prof. Pearson gives as the order of the error.

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SOME SCIENTIFIC CENTRES.

NO. XII.—THE BOTANICAL INSTITUTE OF THE UNIVERSITY OF BONN.

THE traveller visiting the well-kept Rhenish city of Bonn, on taking a stroll down the beautiful Poppelsdorfer Allee, finds at the end of this delightful avenue a large square building within an enclosure, the Poppelsdorfer Schloss. This building, which is two stories high, enclosing a circular court, bears no external evidence of containing within its walls a great centre of biological research, for the edifice was originally a palace, having been used up to the beginning of the last century as a summer residence of the electors of Cologne. The building is now owned by the university, and is occupied by the biological laboratories and the natural history museum. The rooms of the second floor on the north-east and south-east sides are occupied by the botanical laboratories and by the residence of the professor in charge, one of the greatest botanists of all times, Geheimrath Prof. Edouard Strasburger.

The young botanist who is familiar with the writings of Prof. Strasburger, and has formed some idea of this famous botanical institute, on entering the laboratories for the first time is only surprised and perhaps disappointed, for he sees little that suggests a modern and well-equipped laboratory. The fact that the building was erected in the first half of the eighteenth century, and for another purpose, explains why the rooms are not well adapted for their present use. However, the windows are large, and since there is ample room for apparatus and materials, the investigator has little cause for complaint.

The Botanical Institute includes an elementary laboratory, one for advanced students, a large lecture room, and rooms for assistants and the professor extraordinary. The lecture room is provided with a profusion of charts and diagrams for illustrative purposes. The rooms adjoining the laboratories on the south-east side of the building are occupied by the professor as a residence. Two rooms of his residence Prof. Strasburger devotes to his own work, one serving as a laboratory and the other as a library. In these rooms, which are plainly furnished, everything is orderly arranged and kept scrupulously clean. The library contains, in addition to files of periodicals, all the important works on morphology and cytology. Perhaps the most valuable part of the library is the series of reprints on histological sub-

jects. A copy of almost every cytological paper published, whether treating of animal or plant, is to be found here.

The principal windows of the laboratories and of the residence overlook the palace garden, which has been the botanic garden since the founding of the university. The garden, though small in area, is well stocked and rich in flowering plants. The latter occupy the central part of the grounds, which are carefully laid out and arranged according to the system of Eichler. On either side of the central part is the arboretum, containing many fine specimens of European and some American trees. The arboretum is rich in conifers, one, a cedar of Lebanon, being unusually large and beautiful. A portion of the old palace moat is maintained as a pond for aquatics. The large palm house, the Victoria house, and other greenhouses contain many interesting exotics. The garden has also its special beds of poisonous, economic and medicinal plants, as well as one con-



Prof. E. Strasburger. From a photograph by K. Fujii.

taining plants, widely separated in relationship, but which have solved certain problems of adaptation in the same way. But it is neither the laboratories, the library, nor the botanic garden that has made the institute at Bonn famous; rather the enthusiasm, earnestness and profound resourcefulness of the master mind that directs it.

Prof. Strasburger began his notable series of investigations upon the conifers where Hofmeister left off. In 1872 appeared the large volume with numerous plates upon the morphology and fertilisation of conifers and the Gnetaceæ. This was followed in 1879 by another volume, dealing with the embryology of gymnosperms and angiosperms. His attention having been attracted by the nuclear figures in the endosperm during his earlier studies on gymnosperms, he soon brought to publication a series of observations upon nuclear and cell division. Just thirty-two years ago the nucleus was traced in continuous sequence from

one cell-generation to another, thus establishing for the nucleus beyond all question of doubt the rank of morphological unity. The classic and path-breaking work, "Ueber Zellbildung und Zelltheilung," reached the third edition in 1880, while its author was professor at Jena.

Since going to Bonn, Prof. Strasburger's more important contributions, dealing chiefly with the division of the nucleus and of the cell, with the growth of the cell-wall, the structure of the vascular bundle, and with the process of fecundation, have appeared in five or six volumes, each bearing the principal title "Histologische Beiträge." The bulkiest of these volumes (No. 3), and probably one of the most noteworthy, is on the structure of the vascular bundle ("Ueber Bau und die Verrichtungen der Leitungsbahnen in der Pflanzen"). Apart from several other very important monographs, Prof. Strasburger has prepared the best and one of the most elaborate laboratory manuals and handbooks of microscopic technique known to biological science. "Das botanische Practicum" is now in its fourth edition. "Das kleine botanische Practicum," an abridged edition for the use of more elementary students, was also prepared. A translation of this volume by Hillhouse is still one of the very best botanical handbooks in the English language. With the aid of his former collaborators, the late Prof. A. F. W. Schimper, Prof. Fritz Noll, now of the University of Halle, and Prof. Heinrich Schenck, of the Technical University of Darmstadt, the text-book of botany was prepared, which has gone through several editions and has been translated into several languages.

In more recent years the results of certain important investigations carried on in the institute have been published conjointly by Prof. Strasburger and his students. The most important of these is the volume known as the "Cytologische Studien," which marked the beginning of the more modern phases of cytology. The especial value of this collection of papers consists (1) in the perfection of the best cytological methods known at present for a number of widely differing plants, (2) in the proof that no such structures as centrosomes or centrospheres exist in higher plants, and (3) in the complete establishment of true sexuality in the ascomycetes. Occasionally, Prof. Strasburger carries his private work into fields somewhat removed from the general subject of his life work, though such studies have been comparatively few. In this connection may be mentioned the elaborate study with dioecious plants, having for its object to determine, if possible, the effect of environmental conditions upon the control of sex. During the past few years the chief work of the institute has centred about problems relating to the physical basis of heredity, such as the individuality of the chromosomes, the transmission of characters in hybrids, &c.

A glance at the vast amount of literature issued from this most famous centre of cytological research is sufficient to convince one who is not a special student of cytology that the main object and life-work of its director is to understand the meaning of the cell by knowing in the most detailed manner its structure at every step of its activity in all kinds of plants, from the lowest to the highest, and that which has been discovered is only a fair index of what is still to be known.

Probably a summary of the day's programme at the institute will not be without interest to the reader. During the winter semester Prof. Strasburger lectures upon the morphology of the plant groups below the spermatophyta, four lectures being given per week. Once a week, on Fridays, the public lecture is given, which is open to all who wish to attend.

The subject of these public lectures varies from year to year, but it usually pertains to some topic of general interest concerning plants, and is treated from a philosophical standpoint. In the summer semester the lectures deal with the anatomy and physiology of the higher plants. Before going to the lecture room, the professor makes his daily rounds in the advanced laboratories, visiting each investigator, making inquiries concerning the progress made during the past twenty-four or forty-eight hours, and at the same time offering suggestions and criticisms. A visit is frequently made to the laboratory after the lecture or in the afternoon, depending upon the interest in the particular line of study.

Prof. Strasburger's wonderful grasp of the whole field of morphology and physiology, as brought out in frequent discussions in the laboratory, increases daily one's admiration and quickens in one the consciousness of being in the presence of a master mind. When the marvellous results of this centre of scientific research are considered, and the relatively meagre equipment and lack of convenience, the success can only be attributed to the genius of the man who is the centre of its activity and the source of its inspiration.

D. M. MOTTIER.

EXAMINATION v. RESEARCH.

A UNIVERSITY is as much a place for compromise as a party caucus or a church. It has to provide for different needs and to satisfy conflicting interests. It has to preserve its corporate balance against the attacks of specialists and extremists who try to drag it on to a side-track. And it has to do all these things with limited means and limited wisdom. From time to time doubts may well arise as to how far it succeeds in steering the best course. Oxford at present is in the throes of such a discussion. Always critical, she is more critical of herself than of anything less near and dear, and is now enjoying a perfect orgie of self-criticism. But such emotional delights should not lead to oblivion of the fundamental facts of academic life.

Oxford has to find a working compromise between four distinct functions which lead up to four distinct ideals (or exaggerations) of a university. She has to educate, to teach, to examine, and to research, to say nothing of governing herself, which is not, perhaps, the supreme ideal, as our officials are apt to imagine.

(1) Educationally, Oxford is a place where those who can afford it, or are selected by private or public charity as fit recipients of scholarships, may obtain an intellectual training which will fit them (more or less imperfectly) for a number of professional pursuits, and are subjected to a moral discipline which (again somewhat imperfectly) induces them to do less harm to themselves and to create less disturbance in the community than similarly situated youths are wont to do in any other country. Thus Oxford is not an ideal university. But it is as incapable of being the university of Bohemia as of Utopia. Its educational ideal conducts to the perfect gentleman, or, if it fails, to the perfect snob.

(2) As a teaching institution Oxford is expensive, but (on the whole) efficient. It is expensive because it sacrifices the teacher to the taught, and leads the former to bestow upon the latter a great deal of individual attention, more, possibly, than is good for him, more, certainly, than is necessary or than he gets elsewhere. It is efficient because the college spirit is strong, and the competition between the colleges is keen. Wherever this inducement fails, *i.e.* wherever the university conducts the instruction or the college takes no pride in it (*e.g.* in the case of